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| ART UNIT | PAPER NUMBER |
|---|---|
| 2624 | |

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Please find below and/or attached an Office communication concerning this application or proceeding.

| Office Action Summary | Application No. | Applicant(s) | |
|---|---|---|---|
| | 10/625,964 | COUWENHOVEN ET AL. | |
| | Examiner | Art Unit | |
| | Jordan Kuhn | 2624 | |

*-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --*

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

1)☒ Responsive to communication(s) filed on *24 July 2003*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

4)☒ Claim(s) *1-39* is/are pending in the application.

4a) Of the above claim(s) *32-39* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-9,11-16,19,21-23,30 and 31* is/are rejected.

7)☒ Claim(s) *10,17,18,20 and 24-29* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

**Application Papers**

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *20 October 2004* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *7/24/03,8/22/03,10/20/04*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

## DETAILED ACTION

### *Election/Restrictions*

1. Restriction to one of the following inventions is required under 35 U.S.C. 121:

   I. Claims 1-31, drawn to a method of decomposing an image into a multi-frequency band representation and enhancing the image by modifying the multi-frequency band representation, classified in class 382, subclass 260.

   II. Claims 32-39, drawn to a method of providing a user selectable member to independently enhance brightness, latitude, detail contrast, sharpness, or fine detail of an image, classified in class 382, subclass 254.

The inventions are distinct, each from the other because of the following reasons:

2. Inventions II and I are related as combination and subcombination. Inventions in this relationship are distinct if it can be shown that (1) the combination as claimed does not require the particulars of the subcombination as claimed for patentability, and (2) that the subcombination has utility by itself or in other combinations (MPEP § 806.05(c)). In the instant case, the combination as claimed does not require the particulars of the subcombination as claimed because the combination does not require decomposing the image into a multi-frequency band representation. The subcombination has separate utility such as automatically enhancing an image without user intervention.

The examiner has required restriction between combination and subcombination inventions. Where applicant elects a subcombination, and claims thereto are subsequently found allowable, any claim(s) depending from or otherwise requiring all the limitations of the allowable subcombination will be examined for patentability in accordance with 37

CFR 1.104. See MPEP § 821.04(a). Applicant is advised that if any claim presented in a continuation or divisional application is anticipated by, or includes all the limitations of, a claim that is allowable in the present application, such claim may be subject to provisional statutory and/or nonstatutory double patenting rejections over the claims of the instant application.

3. During a telephone conversation with Susan Parulski on December 1, 2006 a provisional election was made with traverse to prosecute the invention of group I, claims 1-31. Affirmation of this election must be made by applicant in replying to this Office action. Claims 32-39 are withdrawn from further consideration by the examiner, 37 CFR 1.142(b), as being drawn to a non-elected invention.

### *Claim Objections*

4. Claim 30 is objected to because of the following informalities: Claim 30 discloses "sharpness of small of fine detail of said image" in line 3 of the claim. The examiner believes this should be, --sharpness of small or fine detail of said image--. Appropriate correction is required.

### *Claim Rejections - 35 USC § 112*

5. The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

6. Claim 9 is rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the enablement requirement. The claim(s) contains subject matter which was not

described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention.

Claim 9 discloses "manipulating said lowest frequency band image to produce a dynamic range or latitude in said digital image". However, the specification is non-enabling for this limitation. The specification discloses at page 7 lines 7-8 that the lowest band is not manipulated for dynamic range control, which actually teaches against this claim. Claim 1 also discloses that the low frequency band image is not modified.

7. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

8. Claims 16, 21-23, and 31 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 16 recites the limitation "said dynamic range control" in line 3 of the claim. There is insufficient antecedent basis for this limitation in the claim.

Claims 21-23 and 31 are dependent on claim 16 and are therefore also rejected under 35 U.S.C. 112.

### *Claim Rejections - 35 USC § 103*

9. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

10. Claims 1-8, 11-14, and 19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Akahori (US Pub No 2003/0179945) in view of Oliyide et al. (US Patent No 5,978,518), hereinafter referenced as Oliyide.

Regarding **claim 1**, Akahori discloses a method for processing images comprising applying a plurality of low pass filters to an image, thereby decomposing the image into a low frequency band image, and a plurality of higher frequency band images, as disclosed at paragraph 61, which reads on "providing a digital image; decomposing the provided digital image into a multi-frequency band representation including a low frequency band image and multiple different high frequency band images", multiplying each of the higher frequency band images by a gain, as disclosed at paragraph 65, which reads on "multiplying each of said high-frequency band images with a gain factor", and summing together the unmodified low frequency band image with the gain multiplied higher frequency band images in order to obtain a reconstructed image, as disclosed at paragraph 73, which reads on "summing together said unmodified low frequency band image and said modified high-frequency band images to produce a reconstructed digital image". However, Akahori fails to specifically disclose mapping the reconstructed image through a tone-scale look-up-table to map the reconstructed image to optical densities. However, the examiner maintains that it was well known in the art to provide for mapping a reconstructed image through a tone-scale look-up-table to map the reconstructed image to optical densities, as taught by Oliyide.

In the same field of endeavor, Oliyide discloses a method for image enhancement comprising decomposing an input image, in which code value is linearly related to log exposure, into a multi-resolution representation having low frequency images and high

frequency images, further comprising applying a tone-scale mapping to a reconstructed version of the input image using a look-up-table to yield densities, as disclosed at column 2 line 66 – column 3 line 27, which reads on "mapping said reconstructed digital image through a tone-scale look-up-table to map said reconstructed digital image to optical densities".

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made, to modify Akahori, by providing for mapping the reconstructed image through a tone-scale look-up-table to map the reconstructed image to optical densities, as taught by Oliyide, for the purpose of applying the system to a log exposure code value image, thereby improving displayed image quality.

Regarding **claim 2**, Akahori and Oliyide disclose everything as applied above (see claim 1). Oliyide further discloses decomposing and enhancing a digital medical image, which reads on "wherein said providing provides a digital medical image", as disclosed at column 2 lines 1-20.

Regarding **claim 3**, Akahori and Oliyide disclose everything as applied above (see claim 1). Oliyide discloses as discussed above in claim 2, decomposing and enhancing a digital medical image. Oliyide further discloses where the digital medical image is a radiographic image which reads on "wherein said providing provides a digital radiological image acquired by one of a medical diagnostic imaging unit, a computed radiography unit, a direct digital radiography unit, and an x-ray film digitizer", as disclosed at column 2 lines 1-20.

Regarding **claim 4**, Akahori and Oliyide disclose everything as applied above (see claim 1). Akahori discloses as discussed above, applying a plurality of low pass filters to

an image, thereby decomposing the image into a low frequency band image, and a plurality of higher frequency band images, wherein this is further exhibited in figure 1, which reads on "wherein said decomposing is effected by processing said provided digital image with a plurality of different low pass filter operators which operate to pass different low-pass images. Said low-pass images are used to generate said low-frequency band image and said multiple different high-frequency band images".

Regarding **claim 5**, Akahori and Oliyide disclose everything as applied above (see claim 4). However, Akahori and Oliyide fail to specifically disclose where the low pass filters are square wave filters. However, the examiner takes OFFICIAL NOTICE that it was extremely well known in the art to decompose an image using a low pass filter, wherein the low pass filter comprises a square wave filter, and it therefore would have been obvious to one of ordinary skill in the art to modify Akahori and Oliyide by providing for where the low pass filters comprise square wave filters for the purpose of optimizing the decomposition of the input image.

Regarding **claim 6**, Akahori and Oliyide disclose everything as applied above (see claim 4). Akahori further discloses where the plurality of low pass filters use different filter kernel sizes, as disclosed at paragraph 61 and exhibited in figure 1, which reads on "wherein said plurality of different low pass filter operators use different filter kernel sizes to pass said different low-pass images".

Regarding **claim 7**, Akahori and Oliyide disclose everything as applied above (see claim 6). Akahori further discloses where the image is decomposed into four frequency band images instead of 3 frequency band images as discussed above, as disclosed at paragraph 83, wherein if the image is decomposed into four frequency band images, first,

second, and third low pass filters are used with corresponding first, second, and third kernels, which reads on "wherein said plurality of different low pass filter operators include first, second and third pass filter operators having respective first, second and third kernels"

Regarding **claim 8**, Akahori and Oliyide disclose everything as applied above (see claim 1). Akahori discloses as discussed above in the rejection of claim 7, where the image is decomposed into four frequency band images, wherein these four frequency band images comprise a lowest, a low-to-mid, a mid-to-high, and a highest frequency band image, wherein it is inherent (based on well known frequency decomposition) that the lowest frequency band image will represent the largest features, the low-to-mid frequency band image will represent smaller features, the mid-to-high frequency band image will represent even smaller features, and the highest frequency band image will represent the smallest features, which reads on "wherein said decomposing decomposes the provided digital image into four frequency bands as follows: a lowest frequency band image which represents large-sized features in the digital image; a low-to-mid frequency band image which represents mid-sized features in the digital image; a mid-to-high frequency band image which represents the small-sized features in the digital image; and a highest frequency band which represents very fine detail in the digital image".

Regarding **claim 11**, Akahori and Oliyide disclose everything as applied above (see claim 8). Akahori further discloses manipulating the middle frequency band image and the high frequency band image when the image is decomposed into 3 frequency band images, wherein the mid-to-high frequency band image and the high frequency band image are modified if the image is decomposed into 4 frequency band images (see the

rejection of claim 8) to enhance the sharpness within those frequency bands, as disclosed at paragraph 80, which reads on "manipulating said mid-to-high frequency band image to produce a sharpness or blurring effect of said small-sized features of said digital image".

Regarding **claim 12**, Akahori and Oliyide disclose everything as applied above (see claim 8). As discussed above, in the rejection of claim 11, Akahori discloses manipulating the middle frequency band image and the high frequency band image when the image is decomposed into 3 frequency band images, wherein the mid-to-high frequency band image and the high frequency band image are modified if the image is decomposed into 4 frequency band images (see the rejection of claim 8) to enhance the sharpness within those frequency bands, as disclosed at paragraph 80, which reads on "manipulating the highest frequency band image to produce a sharpness or blurring effect of very fine detail in said digital image".

Regarding **claim 13**, Akahori and Oliyide disclose everything as applied above (see claim 1). Oliyide further discloses shifting the mean of the image for shifting the brightness of the image to a satisfying level, as disclosed at column 3 lines 43-63, which reads on "wherein said mapping includes a brightness control for shifting the mean density of the digital image".

Regarding **claim 14**, Akahori and Oliyide disclose everything as applied above (see claim 1). Oliyide discloses as discussed above, applying a tone-scale mapping to a reconstructed version of the input image using a look-up-table to yield densities. Oliyide further discloses displaying the densities on a display monitor, but fails to specifically disclose where the displayed image is displayed on the monitor in gray scale. However, the examiner takes OFFICIAL NOTICE that it was extremely well known in the art to

represent radiographic images in gray scale, and it therefore would have been obvious to one of ordinary skill in the art at the time of the invention to modify Akahori and Oliyide by providing for displaying the density image in gray scale for the purpose of reducing processing time versus using a color image.

Regarding **claim 19**, it is interpreted and thus rejected for the same reasons as applied above in the rejection of claim 1.

11. Claim 15 is rejected under 35 U.S.C. 103(a) as being unpatentable over Akahori in view of Oliyide further in view of Shinbata (US Patent No 7,079,700) further in view of admitted prior art (page 6 lines 18-24 of the specification), hereinafter referenced as Admitted.

Regarding **claim 15**, Akahori and Oliyide disclose everything as applied above (see claim 1). As discussed above, Oliyide discloses applying a tone-scale mapping to a reconstructed version of the input image using a look-up-table to yield densities. The examiner maintains that this tone-scale mapping disclosed by Oliyide will have a slope that defines dynamic range control. However, Oliyide does fail to specifically disclose where the tone scale function has slope at a reference density that defines dynamic range control. However, the examiner maintains that it was well known in the art for a tone scale function to have slope at a reference density that defines dynamic range control, as taught by Shinbata.

In the same field of endeavor, Shinbata discloses an image processing method comprising a tone scale function with a slope at a reference density that defines dynamic range control, as disclosed at column 13 line 49 – column 14 line 59 and exhibited in

figure 10, which reads on "wherein in said mapping, said tone scale has slope at a reference density that defines dynamic range control".

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made, to modify Akahori and Oliyide, by providing a tone scale function that has slope at a reference density that defines dynamic range control, as taught by Shinbata, for the purpose of easily altering the dynamic range of an image when preparing it to be displayed, thus improving the appearance of the image on the display device.

However, Akahori, Oliyide, and Shinbata fail to specifically disclose where increasing dynamic range reduces latitude of the image. However, the examiner maintains that it was well known in the art, if not inherent, that when dynamic range increases, latitude decreases, as taught by Admitted. Admitted teaches at page 6 lines 18-24 of the specification, that when dynamic range is increased, latitude is decreased, which reads on "wherein increasing the dynamic range reduces latitude of said digital image, while increasing the dynamic range decreases the latitude to said digital image".

12. Claim 30 is rejected under 35 U.S.C. 103(a) as being unpatentable over Akahori in view of Oliyide further in view of Shinbata further in view of Admitted further in view of Hoppner et al. ("Equalized contrast display processing for digital radiography"), hereinafter referenced as Hoppner.

Regarding **claim 30**, Akahori, Oliyide, Shinbata, and Admitted disclose everything as applied above (see claim 15). However, they fail to specifically disclose where dynamic range control does not affect that detail contrast or sharpness of small or fine detail of the image. However, the examiner maintains that it was well known in the

art to provide for dynamic range control that does not affect detail contrast or sharpness of detail in the image, as taught by Hoppner.

In the same field of endeavor, Hoppner discloses a method for equalized contrast display processing comprising allowing for the adjusting of image latitude and detail contrast independently by applying a low pass filter to the image in order to divide the image into a low frequency band image and a high frequency band image, as disclosed at Section 4 – page 620, which reads on "wherein manipulation of said dynamic range control does not affect the detail contrast or sharpness of small of fine detail of said image".

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made, to modify Akahori, Oliyide, Shinbata, and Admitted, by providing for dynamic range control that does not affect detail contrast or sharpness of detail in the image, as taught by Hoppner, for the purpose of modifying the dynamic range of an image to make it more visible on different display devices, without affecting image contrast and quality.

### *Allowable Subject Matter*

13. Claims 10, 17-18, 20, and 24-29 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

14. Claims 16, 21-23, and 31 would be allowable if rewritten to overcome the rejection(s) under 35 U.S.C. 112, 2nd paragraph, set forth in this Office action and to include all of the limitations of the base claim and any intervening claims.

***Conclusion***

15. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Vuylsteke (US Patent No 5,467,404 and 5,644,662) discloses a method for enhancing an image by dividing the image into a plurality of band pass images, manipulating the bands separately, recombining the bands, and mapping the reconstructed image for display. Takeuchi (US Pub No 2001/0017619) discloses a method for adjusting the quality of a displayed image wherein a user can adjust brightness, contrast, and sharpness independently.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Jordan Kuhn whose telephone number is 571-272-4295. The examiner can normally be reached on M-F 8:00AM-4:30PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Bhavesh Mehta can be reached on 571-272-7453. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

ISHRAT SHERALI
PRIMARY EXAMINER

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